Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/32**

Paper 3 Advanced Practical Skills 2 **May/June 2020**

2 hours

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

For Examiner's Use	
1	
2	
Total	

This document has **16** pages. Blank pages are indicated.

[Turn over

Before you proceed, read carefully through the **whole** of Question 1 and Question 2.

Plan the use of the **two hours** to make sure that you finish the whole of Question 1 and Question 2.

1 When plant cells are placed into sodium chloride solution, osmosis occurs and water will enter or leave the vacuoles. Some cells may become plasmolysed. A cell is described as being plasmolysed when the cell surface membrane detaches from the cell wall.

You will investigate the effect of different concentrations of sodium chloride solution on onion tissue.

You will need to:

- prepare different concentrations of sodium chloride solution using proportional dilution of 4.0% sodium chloride solution
- observe and record the effect of adding these concentrations of sodium chloride solution to the onion tissue.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
X	2 pieces of onion tissue in distilled water	none	–
S	4.0% sodium chloride solution	none	50
W	distilled water	none	50

It is recommended that you wear suitable eye protection.

You will need to prepare different concentrations of sodium chloride solution, **S**, using **proportional** dilution. You will need to prepare 10 cm^3 of each concentration.

(a) (i) Table 1.2 shows how to make up two of the concentrations of **S** you will use.
Decide which **three** other concentrations of **S** you will use.

Complete Table 1.2 for the other concentrations you will use.

Table 1.2

percentage concentration of sodium chloride solution	volume of S / cm^3	volume of W / cm^3
4.0	10.0	0.0
0.0	0.0	10.0

[2]

Carry out step 1 to step 14.

1. Prepare the concentrations of sodium chloride solution, as shown in Table 1.2, in the beakers provided.

2. Put one **clean and dry** microscope slide on a paper towel.

3. Put a few drops of **W** onto the microscope slide.

4. Remove one piece of onion tissue from beaker **X**. Peel off the inner epidermis as shown in Fig. 1.1.

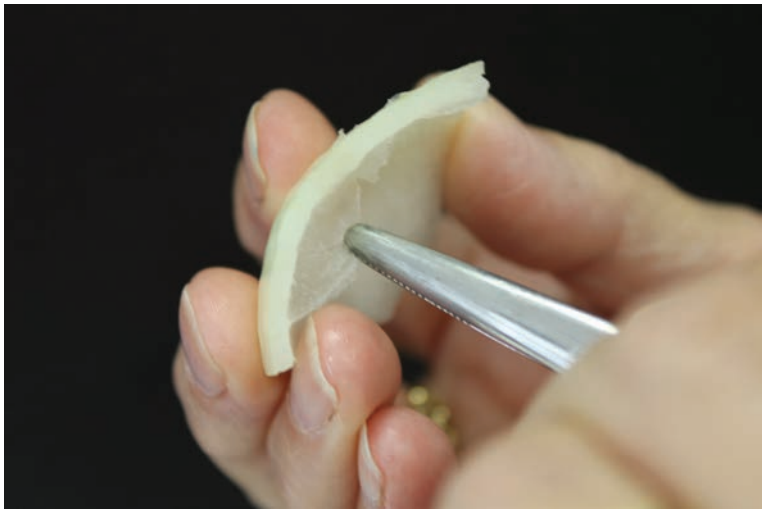

Fig. 1.1

5. Cut one piece of the inner epidermis so that it will fit under a coverslip. Put any remaining epidermis into the beaker labelled **For waste**.

6. Put the epidermis into **W** on the microscope slide, as shown in Fig. 1.2. If the epidermis is folded, you may need to add more drops of **W** so that it floats and uncurls. It is important to stop the epidermis from drying out.

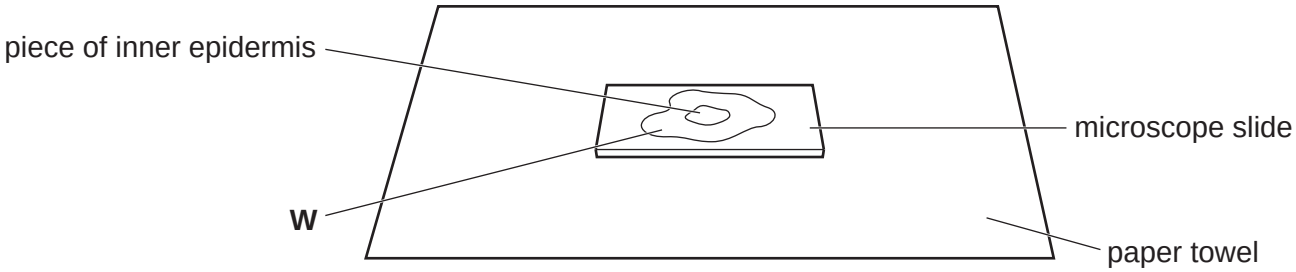

Fig. 1.2

7. Put a coverslip over the piece of epidermis on the microscope slide. Use a paper towel to remove any excess **W** that is outside the coverslip.

8. Observe the epidermis using the low power lens of the microscope. You may need to reduce the amount of light entering the microscope to observe the cells clearly.

You will need to observe and record the effect of adding **W** and the different concentrations of sodium chloride solution on the onion tissue. You will do this by counting the number of plasmolysed cells within a sample of cells.

(ii) Decide the total number of cells in your sample.

State the total number of cells in your sample ..... [1]

9. Count the number of plasmolysed cells observed in your sample for **W**. Record your results in **(a)(iii)**.

10. Take the microscope slide off the microscope and remove the coverslip.

11. Use a paper towel to remove **W** from around the epidermis.

12. Put a few drops of the **lowest concentration** of sodium chloride solution you prepared in step 1 onto the epidermis.

13. Repeat step 7 to step 11 using the lowest concentration of sodium chloride solution instead of **W**.

14. Repeat step 12 to step 13 using the remaining concentrations of sodium chloride solution. The 4.0% sodium chloride solution is used last.

(iii) Record your results in an appropriate table.

[3]

(iv) Using the **high power** lens, select three adjacent, touching cells that show the effect of adding 4.0% sodium chloride solution.

Make a large drawing of these **three** adjacent, touching cells. Use a sharp pencil for drawing.

Use **one** ruled label line and label to identify a cell surface membrane of **one** cell.

[4]

(v) Use your knowledge of water potential to explain the appearance of the inner epidermal cells in 4.0% sodium chloride solution.

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..... [2]

(vi) Suggest how you could modify the procedure to have more confidence in your results.

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..... [2]

(b) A student investigated the effect of different concentrations of sucrose solution on pieces of potato tissue. The student used the results to determine the mean percentage change in length of the pieces of potato tissue.

- Pieces of potato tissue were cut to exactly the same length and cross-sectional area.
- Each piece of potato tissue was put into a different concentration of sucrose solution for 1 hour.
- After 1 hour the length of each piece of potato tissue was measured and the percentage change in length was calculated.
- Five replicates were done for each concentration.

The student then calculated the mean percentage change in length of potato tissue for each concentration of sucrose solution.

The processed data are shown in Table 1.3.

Table 1.3

concentration of sucrose solution / mol dm^{-3}	**percentage change in length**					**mean percentage change in length**
0.0	+2.60	+1.90	+2.80	+2.60	+2.80	+2.70
0.2	+0.25	+0.35	+0.35	+0.30	+0.25	+0.30
0.4	–1.40	–1.40	–1.35	–1.40	–1.45	–1.40
0.6	–2.20	–2.25	–2.20	–2.15	–2.20	–2.20
0.8	–2.60	–2.50	–1.60	–2.60	–2.70	
1.0	–2.90	–3.00	–2.85	–3.15	–3.10	–3.00

(i) Complete Table 1.3 by calculating the mean percentage change in length of the potato tissue in 0.8 mol dm^{-3} sucrose solution.

[1]

(ii) Plot a graph of the mean data in Table 1.3 on the grid in Fig. 1.3.

Use a sharp pencil for drawing graphs.

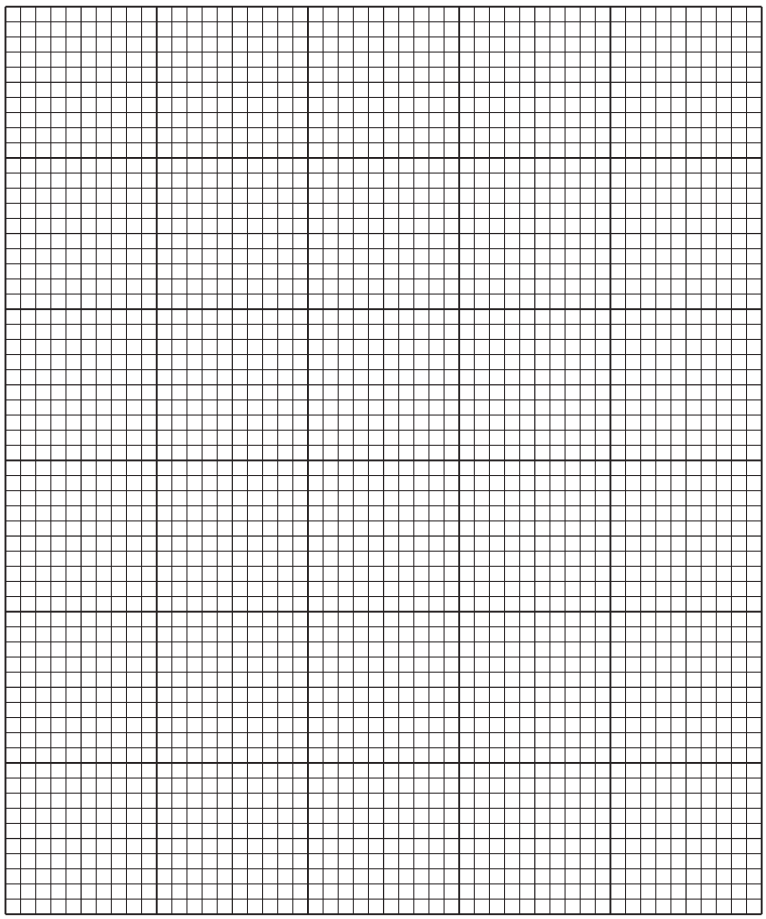


Fig. 1.3

[4]

(iii) Fig. 1.4 is a calibration curve of sucrose concentration against water potential.

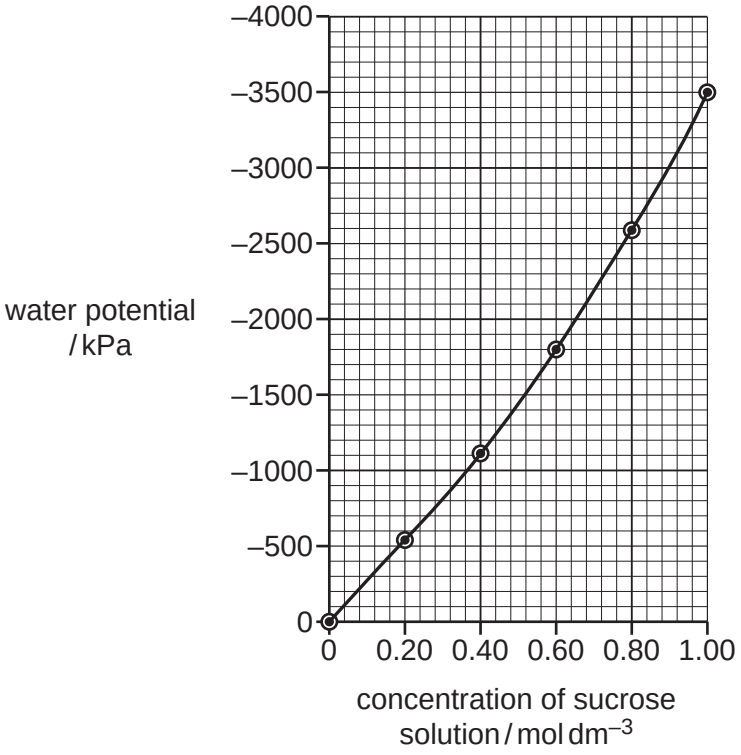


Fig. 1.4

Use the graphs in Fig. 1.3 **and** Fig. 1.4 to determine the water potential of the cells in potato tissue.

Show on the graphs how you determined your answer.

water potential of cells in potato = ... [3]

[Total: 22]

2 Water moves through xylem vessel elements in plants. The diameter of xylem vessel elements varies between different species of plant.

You will measure how quickly coloured water moves through xylem vessel elements of different diameters. You will use microscope slides to represent xylem vessel elements of different diameters.

You are provided with the materials shown in Table 2.1.

Table 2.1

labelled	description	hazard
P	container with 6 pieces of paper	none
R	beaker containing coloured water	none

Carry out step 1 to step 9.

1. Put one clean, dry microscope slide on the bench.
2. Put **two** pieces of paper from the container labelled **P** on top of the microscope slide.
3. Put another microscope slide on top of the paper.
4. Put tape around the two microscope slides to hold them together as shown in Fig. 2.1**A**.
5. Label this pair of microscope slides, **A**.
6. Repeat step 1 to step 4 using **four** pieces of paper instead of **two** pieces of paper, as shown in Fig. 2.1**B**.
7. Label this pair of microscope slides, **B**.

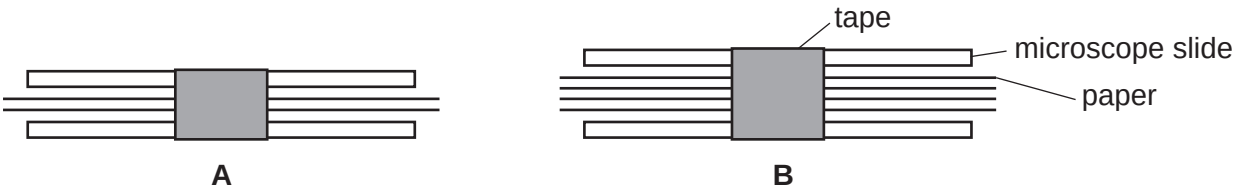


Fig. 2.1

8. Hold **A** by the side edges and remove the paper.
   You should be left with a gap as shown in Fig. 2.2.
9. Repeat step 8 for **B**.

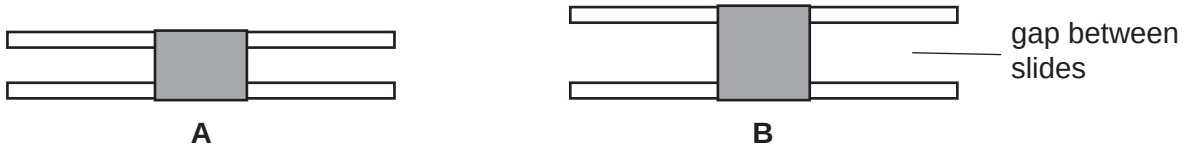


Fig. 2.2

10. Put **A** into the beaker labelled **R**, as shown in Fig. 2.3. Start timing **immediately** and record in Table 2.2 the time it takes for the coloured water to reach the top of the pair of microscope slides. If the time taken is longer than 60 seconds record the result as 'more than 60'.

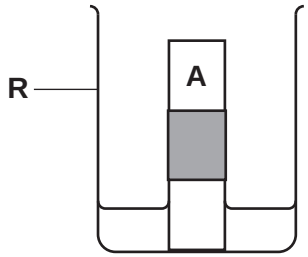


Fig. 2.3

11. Repeat step 10 using **B** instead of **A**.

(a) (i) Record your results in Table 2.2.

Table 2.2

pair of microscope slides	number of pieces of paper used to make gap	time for coloured water to reach the top of the microscope slides / s
A	2	
B	4	

[1]

(ii) Identify **one** significant source of error when measuring the dependent variable.

.....

.....

..... [1]

(iii) Using your results in Table 2.2 suggest how the diameter of xylem vessels affects the transport of water in a plant.

.....

..... [1]

(b) Fig. 2.4 is a photomicrograph of a stained transverse section through a leaf.

You are not expected to be familiar with this specimen.

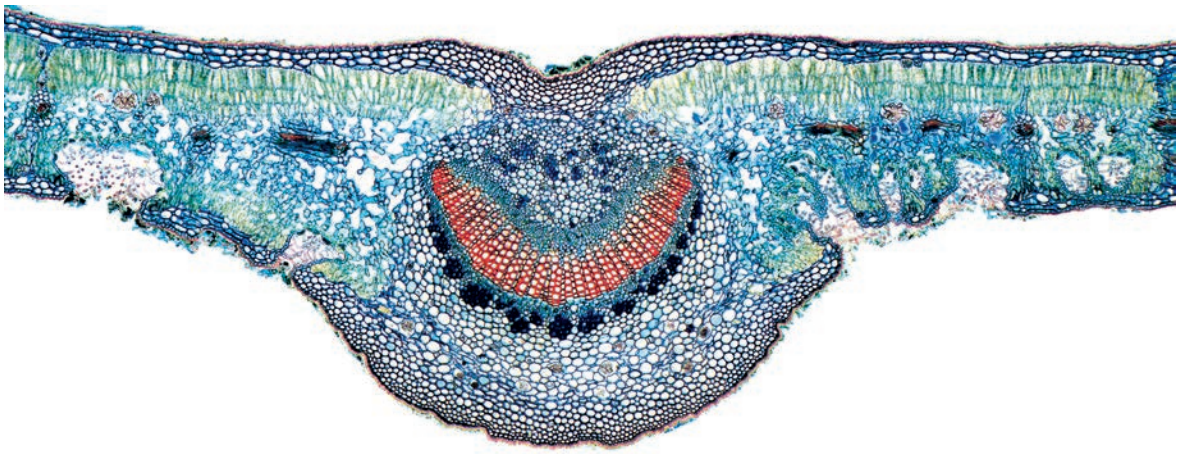


Fig. 2.4

Use a sharp pencil for drawing.

You are expected to draw the correct shape and proportions of the different tissues.

(i) Draw a large plan diagram of the section shown in Fig. 2.4.

Use **one** ruled label line and label to identify the upper epidermis.

[6]

Fig. 2.5 is a photomicrograph of a stained transverse section through a leaf of a different type of plant.

You are not expected to be familiar with this specimen.

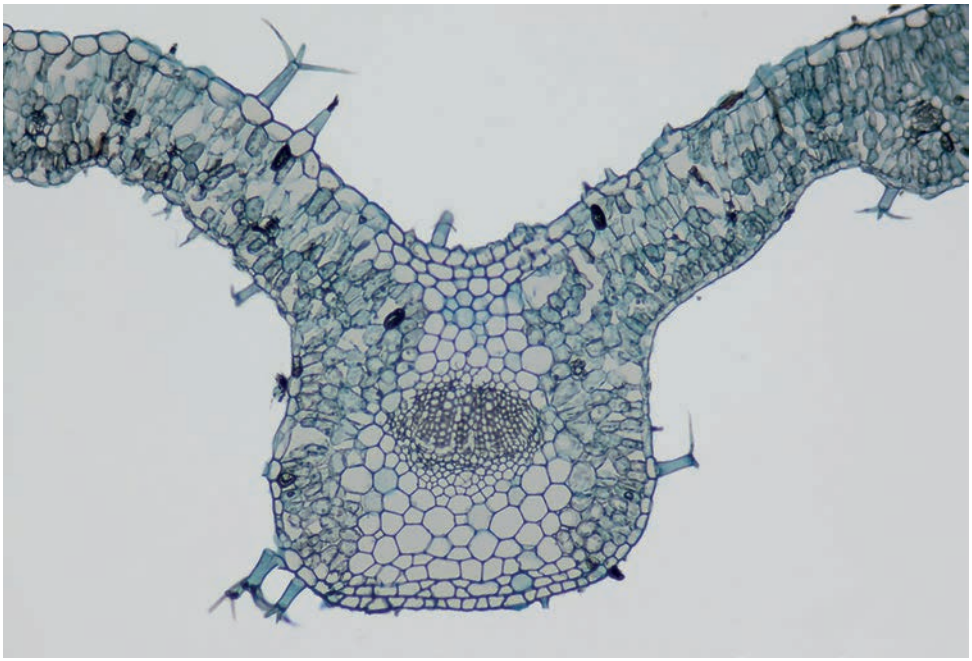


Fig. 2.5

(ii) Identify the observable differences between the leaf in Fig. 2.4 and the leaf in Fig 2.5.

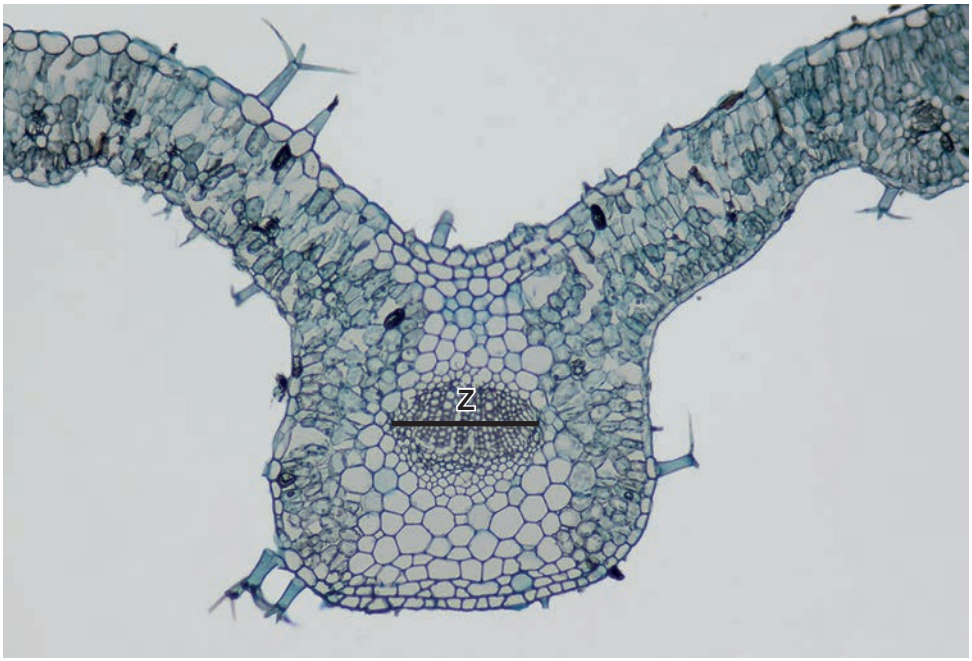
Record the observable differences in Table 2.3.

Table 2.3

feature	Fig. 2.4	Fig 2.5

[4]

(c) Fig. 2.6 is the same photomicrograph as in Fig. 2.5 but with line **Z** added to show the diameter of the vascular bundle.



magnification x200

Fig. 2.6

(i) Use the magnification and the line **Z** on Fig. 2.6 to calculate the actual diameter of the vascular bundle.

Show all the steps in your working and use appropriate units.

actual diameter of vascular bundle = ... [4]

(ii) State **one** piece of apparatus you would use to measure a specimen on a slide using a microscope fitted with an eyepiece graticule.

..... [1]

[Total: 18]

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